# A contribution to the knowledge of the taxonomy and the ethology of the genus *Masarina* Richards (Hymenoptera: Masaridae)

by

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CONTENTS



ABSTRACT

Descriptions of the female of *Masarina strucki* **sp. nov.**, and the previously undescribed female of *M. hyalinipennis* Richards and male of *M. mixta* Richards are given. A revised key to species is presented. A first account of the nesting of a species of the genus *Masarina* Richards is given. *M. familiaris* Richards nests in vertically presented soil in multicellular nests, attaches the egg to the cell wall and provisions with a wet pollen and nectar mixture. It forages on *Aspalathus* spp. (Leguminosae).

INTRODUCTION

The genus *Masarina* Richards, 1962, endemic to southern Africa, when erected included three species, two of which were known only from one sex. The present taxonomic contribution based on material collected by M. Struck in the Hester Malan Nature Reserve, Springbok and by the Gesses in the Clanwilliam district adds a fourth species, at present known from the female only, and completes the descriptions of the two species previously known from one sex only.

Nothing has hitherto been published regarding the biology of the genus. The data presented are the results of an investigation made during a six day visit to the Clanwilliam district, western Cape Province, South Africa.

## TAXONOMIC DESCRIPTIONS (by **F. W. Gess**)

### *Masarina strucki* sp. nov.

Female

Black; a spot at top of tempora behind eyes, a narrow interrupted band along dorsal hind margin of pronotum, a streak on humeral angles, a spot on prepectus, a median spot on posterior half of scutellar disk and a narrow streak along baso-lateral margins of scutellum, transverse posterior bands on tergites 1–5 (somewhat widened medially and at sides), *yellowish-white*. Underside of flagellomeres (especially those composing club), tegulae, distal extremities of femora, entire tibiae and tarsi of all legs, *orange*. Mandibles in part *reddish-brown*.

Length 7,5 mm; length of fore wing 4,9 mm.

Clypeus strongly raised from sides, disk widely and deeply longitudinally depressed, ventral margin trilobed (that is, with a rounded median lobe and on each side a slightly upturned lamellate angular lobe), surface of entire clypeus markedly longitudinally aciculate; frons with its lower third raised laterally and widely depressed medially to match form of clypeus, over most of its area longitudinally aciculate like clypeus. Puncturation of thorax moderate but close, that of abdomen fine but close. Scutellum moderately raised above mesoscutum, falling vertically into a narrow, smooth anterior furrow. Propodeum with obtuse tubercles near top of angles. Tergite 6 transversely impressed distally. Shorter hind tibial spur simple.

Male unknown.

Material Examined: [Cape Province:] Namaqualand, [Springbok] 2917 DB, Hester Malan N[ature] R[eserve], 20.viii.1985 (M. Struck) Holotype female.

Etymology: The name, in the genitive singular, is formed from the name of the collector of the present specimen, Mr Michael Struck of Hamburg, West Germany, whose help in locating good study areas in the Hester Malan Nature Reserve is hereby gratefully acknowledged.

### *Masarina hyalinipennis* Richards

Female (hitherto undescribed)

Black; small to minute spot on each side of face above ocular sinus, narrow streak at top of tempora behind eyes, tegulae, entire raised disk of scutellum, tergite 1 and 2 (except for anterior declivity of 1, narrow base of 2 and sides of both), a narrow transverse posterior band medially on tergite 3, parts of tibiae of all legs and entire tarsi of fore legs, *various shades of red*.

Length 8,7–9,8 mm (av. of 5: 9,1 mm); length of fore wing 6,8–7,3 mm.

Clypeus moderately raised from sides, disk a little depressed in midline, ventral margin widely and shallowly emarginate with a small, erect, rounded central tooth, lamellate margin wide; surface of clypeus dull, finely aciculate (especially in depression) with moderate punctures becoming closer at sides. Frons similarly finely aciculate (especially medially). Rest of head, thorax and abdomen moderately punctured. Scutellum falling steeply into a wide coarsely crenulate anterior furrow. Propodeal angles weakly developed, almost rounded. Tergite 6 transversely impressed distally. Generally quite similar to the male.

Material Examined: [Cape Province:] Namaqualand, [Springbok] 2917 DB, Hester Malan N[ature] R[eserve], 20.viii.1985 (M. Struck) 4 females, 28.viii,1985 (M. Struck) 2 males, 25.ix.1986 (M. Struck) 1 female.

### *Masarina mixta* Richards

Male (hitherto undescribed)

Black; gastral tergites 1–2 *red*, contrasting markedly with rest of tergites. Antennal club beneath, parts of tibiae and tarsi (especially those of fore legs), *orange*. Disk of clypeus, broad supraclypeal marking on face, whole of labrum, proximal half of mandibles, a spot at top of tempora behind eyes, pronotal dorsum medially and humeral angles, *yellowish-white*.

Length 6,5 mm, length of fore wing 4,7 mm.

Like the female characterized by the broad, triangular, black tegulae; other shared characters are the simple shorter hind tibial spur, the scutellum which is anteriorly almost on the same level as the mesoscutum, and the propodeum which has obtuse tubercles near the top of the angles. Tergite 7 only weakly transversely impressed, apically rounded; proximal sternites unmodified. Puncturation similar to that of female.

Material Examined: Cape Province: Clanwilliam District, Kransvlei (32° 14′ 3″ S, 18° 50′ 49″ E), 7–13.x.1987 (F. W. and S. K. Gess) 1 male; Clanwilliam District, 5 km W of Clanwilliam, road to Graafwater, 12.x.1987 (F. W. and S. K. Gess) 1 female (on flowers of *Aspalathus desertorum* Bol., Leguminosae); Clanwilliam District, Witelskloof (32° 20′ S, 18° 48′ E), 13.x.1987 (F. W. and S.K. Gess) 1 female; Clanwilliam District, Klein Alexandershoek (32° 20′ 20″, 18° 46′ E), 8–13.x.1987 (F. W. and S. K. Gess) 2 females (on ground).

## KEY TO THE SPECIES OF *MASARINA* RICHARDS

The present key is based upon that of Richards (1962: 268) but is augmented by the inclusion of the female of *M. strucki* **sp. nov.**, the hitherto unknown male of *M. mixta* Richards and the hitherto unknown female of *M. hyalinipennis* Richards.

1. Tegula black, broad, triangular. Thorax entirely black in female, black except for yellowish-white markings on pronotal dorsum and on humeral angles in male; markings on abdomen reddish, largely confined to tergites 1 and 2 (and in female to parts of corresponding sternites). Shorter hind tibial spur simple. Male with clypeal disk, broad supraclypeal marking on face, whole of labrum and proximal half of mandibles yellowish white; with tergite 2 unmodified and tergite 7 rounded ..... *mixta Richards*
— Tegula reddish, long, pyriform. Thorax with at least tip of scutellum reddish or yellow; markings on abdomen reddish, yellow, or both, not confined to first two tergites. Shorter hind tibial spur simple or bifid .....2
2. Thorax with yellow markings; abdomen black with narrow yellow posterior bands on tergites 1–5. Shorter hind tibial spur simple. (Male not known.) ..... *strucki* **sp. nov.**
— Thorax without yellow markings but with at least tip of scutellum reddish and other markings, if present, of that colour; abdomen with extensive reddish markings and with yellow, if present, confined to lateral or medial spots. Shorter hind tibial spur bifid ....3
3. Face on each side above ocular sinus with a large yellow spot; abdomen with yellow markings in addition to reddish ones. Propodeal angles strongly developed, tuberculate.

Scutellum with a narrow smooth anterior furrow. Puncturation of head, thorax and abdomen coarse. Male with clypeal disk and narrow supraclypeal marking on face yellow, labrum black and mandibles largely reddish; with sternite 2 unmodified and with tergite 7 emarginate apically ..... *familiaris* Richards

— Face on each side above ocular sinus with a small to minute reddish spot (absent in male); abdomen with reddish markings only. Propodeal angles weakly developed, almost rounded. Scutellum with a wide coarsely crenulate anterior furrow. Puncturation of head, thorax and abdomen moderate. Male with clypeal disk and a narrow supraclypeal line on face pure white, labrum and mandibles black; with sternite 2 bearing a bituberculate prominence and with tergite 7 rounded ..... *hyalinipennis* Richards

## SOME ASPECTS OF THE ETHOLOGY OF *MASARINA FAMILIARIS* RICHARDS

*Geographic distribution*

*Masarina familiaris* Richards seems to be an essentially south western Cape species with a distribution extending to the fringes of Namaqualand in the north and to Willowmore in the east. Richards (1962) gives collecting records for Camps Bay, Stellenbosch, Ceres, Clanwilliam, Nieuwoudtville, Ladismith and Willowmore.

Additional records (all Albany Museum) are:

Ladismith, 23.ix.1948, 1 female; 24.ix.1948, 1 female; and 26.ix.1948, 1 female (all C.F. Jacot Guillarmod).

Citrusdal, 2.xi.1966 (J. G. Rozen) 1 male.

Clanwilliam District:

Kransvlei (32° 14′ 3″ S, 18° 50′ 49″ E), 7–13.x.1987 (F. W. Gess and S. K. Gess) 9 females, 4 males.

6–9 km N of Paleisheuvel on road to Clanwilliam, 13.x.1987 (F. W. Gess and S. K. Gess) 4 females.

Clanwilliam Dam (32° 11′ 30″ S, 18° 53′ 42″ E), 14.x.1987 (F. W. Gess and S. K. Gess) 10 females, 1 male.

Witelskloof (32° 20′ 35″ S, 18° 48′ E), 13.x.1987 (F. W. Gess and S. K. Gess) 1 male.

Klein Alexandershoek (32° 20′ 20″ S, 18° 46′ E), 28.ix.1985 (F. W. Gess and S. K. Gess) 1 male and 8–13.x.1987 (F. W. Gess and S. K. Gess) 10 females, 5 males.

5 km W of Clanwilliam on road to Graafwater, 12.x.1987 (F. W. Gess and S. K. Gess) 3 females.

*Description of the Clanwilliam district*

Clanwilliam lies in the Olifants River Valley with to the east the Cederberg Mountains and to the west a hilly area with beyond it the coastal plain. Apart from the sandy coastal plain the whole area is classified geologically as Table Mountain Series. The soils are derived from quartzitic sandstone and shale and are therefore a mixture of sand and clay the proportions of each varying from area to area resulting in their being of variable friability.

The vegetation of the Olifants River Valley to the north of, around and some way to the south of Clanwilliam is described by Acocks (1953) as Veld Type 31, Succulent Karoo, and that further to the south extending almost to Citrusdal as Veld Type 26, Karroid Broken Veld. That of the high lying areas is Veld Type 69, Macchia (Fynbos) and that of the coastal plain is Veld

Type 34, Strandveld. Moll *et al* (1984) re-described the major vegetation categories in and adjacent to the Fynbos Biome. They categorize the area in the immediate vicinity of Clanwilliam a "Mosaic of Dry Mountain Fynbos and Karroid Shrublands" and the high lying areas to the west and east "Mesic Mountain Fynbos", changing to "Dry Mountain Fynbos" further to the west on the fringes of the coastal plain.

The six sites at which *Masarina familiaris* was collected were all characterized by the presence of some Fynbos species and, at the time when the wasps were collected, flowering *Aspalathus* sp./spp. (Leguminosae). Klein Alexandershoek and Witelskloof are situated in Mesic Mountain Fynbos, and the site 6–9 km N of Paleisheuvel and that 5 km W of Clanwilliam on the road to Graafwater are situated in Dry Mountain Fynbos. That at Clanwilliam Dam is a sparsely vegetated slope above the caravan park and that at Kransvlei is a transition area, the vegetation being a mosaic of Succulent Karoo, Karroid Broken Veld and Fynbos.

*Plants visited*

During the period 7–14.x.1987 a wide range of plants in flower in the Clanwilliam district was sampled for wasp visitors. *Masarina familiaris* was found to be visiting *Aspalathus* spp. (Leguminosae) exclusively. Three species of yellow flowered *Aspalathus*, *Aspalathus desertorum* Bol., *Aspalathus vulnerans* Thunb. and *Aspalathus* sp.(small shrub with ericoid leaves) (Fig. 1) were being visited by both females and males.

*Aspalathus desertorum*—Clanwilliam Dam, 10 females, 1 male.
Klein Alexandershoek, 9 females, 5 males.
Witelskloof, 1 male.
6–9 km N of Paleisheuvel, road to Clanwilliam, 3 females.
5 km W of Clanwilliam on the road to Graafwater, 3 females.

*Aspalathus vulnerans* —6–9 km N of Paleisheuvel, road to Clanwilliam, 1 female.

*Aspalathus* sp. —Kransvlei, 6 females, 4 males.

*Provision*

Provision was obtained from nine cells from four nests from two nesting sites. In all instances it was extremely wet and sticky, not forming a distinct "pollen loaf". Pollen in all instances was of one size, 22,5 $\mu$ in diameter. When compared with that extracted from flowers of *Aspalathus desertorum* and *Aspalathus* sp. it was found to be identical.

M. familiaris *as a possible pollinator of* Aspalathus desertorum

The flowers of *Aspalathus desertorum* were observed to be visited by the masarid wasps *M. familiaris* and *Ceramius clypeatus* Richards, various bees, beetles and some non-masarid wasps, however, the two masarid wasps seemed to be the only species which penetrated deeply into the flowers and spent any considerable time working in a flower. Whilst gathering pollen but more particularly nectar from these flowers it seems likely that they serve the flowers as pollinators. *M. familiaris* being considerably smaller than *C. clypeatus* is probably the better suited having a better fit to the small flowers.

*Description of the nesting sites*

Four nesting sites of *Masarina familiaris* were located. Three were at Kransvlei (Figs 1, 2 and 3) and one at Klein Alexandershoek. At all sites nesting was in vertically presented soil, the

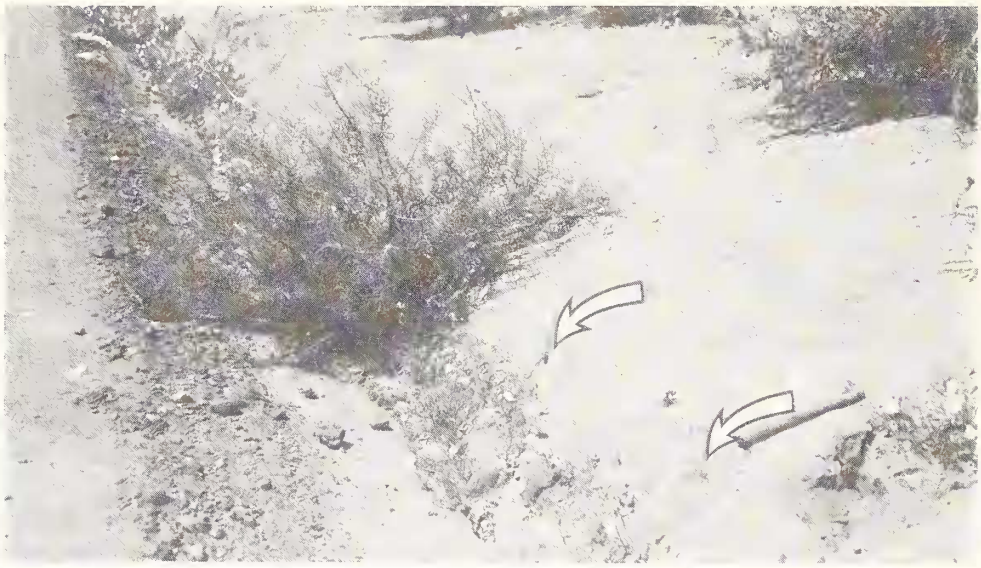

Fig. 1. A nesting site of *M. familiaris* Richards, a roadside bank, Kransvlei, 12.x.1987. Positions of nests arrowed. Forage plant, *Aspalathus* sp., in middle distance.

Fig. 2. A nesting site of *M. familiaris* Richards, Kransvlei, 10.x.1987. Two turrets arrowed.

Fig. 3. A nesting site of *M. familiaris* Richards, Kransvlei, 10.x.1987. Two turrets arrowed.

height of the banks varying from 15–100 cm and the nests being excavated at heights of a few centimetres to half a metre. The soil of the nesting sites at Kransvlei is a very hard, non-friable red clay-sand mixture with a relatively high proportion of clay whereas that at Klein Alexandershoek is a relatively friable, sand coloured clay-sand mixture with a relatively low proportion of clay. That at Klein Alexandershoek can, however, with the addition of water be formed into durable "bricks".

The nests occurred singly and also grouped in the vicinity of an old nest suggesting that there is a tendency for newly emerged females to initiate their nests in close proximity to the nest from which they themselves emerged.

*Description of the nest*

The nest of *M. familiaris* consists of a multicellular burrow with at its entrance a downwardly curved tubular mud turret (Figs 4 and 5). The turret is constructed of mud pellets smoothed on the inside but left rough on the outside. A large number of the interstices are left open so that the turret has a somewhat lacy appearance. The turret and shaft entrance are both of the same diameter. There are one or more sub-horizontal to upwardly or downwardly sloping shafts each ending in a cell (Fig. 5). All those shafts leading to sealed cells are filled with earth (Fig. 5, Nests 3 and 7). A completed nest is finally sealed with a mud-plate at the burrow entrance (Fig. 5, Nest 3). A cell is, over most of its length, of the same diameter as that of the shaft. There is a distinct neck of smaller diameter than that of the cell and shaft. Distally the cell walls slope inwards abruptly to a truncate end wall.

Fig. 4. Turret of *M. familiaris* Richards, the nearer of the two turrets arrowed in Fig. 3. (x 2)

*Method of construction of the nest, oviposition and provisioning*

Water is required for nest construction. At an early stage in burrow excavation turret construction is initiated using pellets extracted from the excavation. At the commencement of turret construction pellets are laid down around the shaft opening in such a way that the turret will have the same diameter as that of the shaft, that is 3,5 mm (range 3,5–5 mm, sample of 6). The thickness of the turret wall is 0,5 mm (outer diameter of turret = 4,5 mm, range nil, sample of 5). Almost from the start the additional pellets are added in such a way that the turret curves over and downwards (Fig. 4). After turret construction has been completed further pellets extracted from the excavation are dropped so that they accumulate in a pile at the base of the bank beneath the nest.

The shafts are short and generally slope downwards although they may less commonly slope upwards (in a sample of 15, 13 sloped downwards and 2 upwards). The average angle of slope for the sample was 26°. A shaft is extended without change of angle to end in a cell. Cell excavation is preceded by a reduction of 1 mm in the diameter of the shaft over a short distance to form a neck. After the neck has been created the diameter returns to that of the shaft until the inner end of the cell is approached so that the cell walls are parallel over most of the length of the cell. Shortly before the end of the cell is reached there is a rapid reduction in diameter so that the sides slope inwards to the end of the cell which is truncate, not curved. The average length of the cells of the sample was 11,5 mm.

The excavated cell is very carefully smoothed and shaped so that, although a mud cell is not constructed within it, the walls of the cell are stabilized to such a degree that in nests constructed in relatively friable soil parts at least of the cell walls can be separated from the surrounding soil.

A cell having been constructed an egg is laid at the inner end. The egg is yellow and curved, and is attached by one end to the upper side of the cell so that it lies across the end wall.

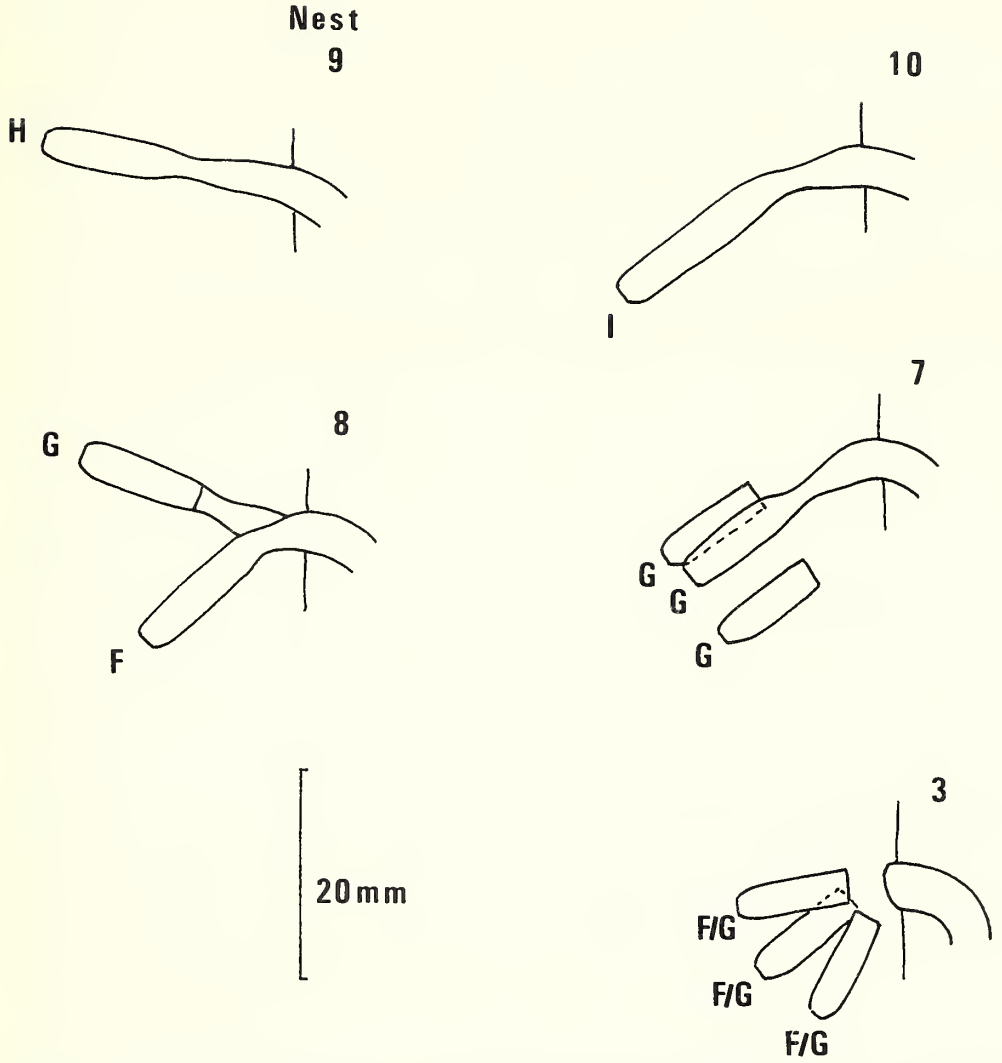


Fig. 5. Vertical plans of the turrets and underground workings of nests of *M. familiaris* Richards. Nests 3, 8, 9 and 10, Kransvlei and Nest 7, Klein Alexandershoek. For key to lettering see Table 1.

After oviposition provisioning takes place. The provision which is a mixture of pollen and nectar is very wet and sticky. Being wet it has no discrete shape of its own. It occupies about two thirds of the cell.

Provisioning having been completed the cell is sealed with a thin mud plate and the shaft is filled with earth. A second shaft is then excavated diverging from the first immediately inside the nest entrance and terminating in a cell which is completed and sealed in the same manner. Several shafts each terminating in a cell may be similarly excavated and completed. When a nest has been completed the burrow entrance is sealed with a mud-plate.

Ten nests were excavated. Of these two were newly initiated nests consisting only of a turret and short shaft, three were single-celled, two two-celled, two three-celled and one four-celled. The nature of the contents of these cells is indicated in Table 1. The cocoon spun by the fully grown larva is firmly attached to the cell walls. There was no indication of nests being used by this wasp for more than one season.

TABLE 1. Details pertaining to the 10 nests of *Masarina familiaris* excavated in the Clanwilliam district.

| Nest No. | Turret | No. of cells | Nature of each cell, cell contents | Remarks |
|---|---|---|---|---|
| 1 | Absent | 2 | A Y | Old nest<br>*Hoplitis* sp. female in nest |
| 2 | Present | 4 | F/G* B/C Z Z | *M.familiaris* female in nest<br>*Hoplitis* sp. in attendance |
| 3 | Present | 3 | F/G*F/G*F/G* | Nest entrance sealed |
| 4 | Present | 0 | — | Newly started nest |
| 5 | Present | 0 | — | Newly started nest |
| 6 | Present | 1 | H | *M.familiaris* female in nest |
| 7 | Present | 3 | G G G | |
| 8 | Present | 2 | G F | |
| 9 | Present | 1 | H | *M.familiaris* female in nest |
| 10 | Present | 1 | I | *M.familiaris* female in nest |

Key: * indicates that no egg or larva was found
A. Cell open, containing old cocoon from which adult wasp has emerged.
B. Cell closed, containing pupa in cocoon.
C. Cell closed, containing prepupa in cocoon.
F. Cell either open or closed, containing still feeding immature larva.
G. Cell either open or closed, containing egg with provision.
H. Cell open, containing egg without provision.
I. Cell open, empty.
Y. Old cell containing bee cell.
Z. New cell containing bee cell.

*Associated insects*

Two of the nests of *M. familiaris* investigated were being attended by a small (6,3 mm long) black bee, *Hoplitis sp.*. One nest (Nest 1) was an old two-celled nest which lacked a turret and the other (Nest 2) was a newly constructed turreted four-celled nest (Table 1). Nest 1 was clearly

an old, disused nest of *M. familiaris* and Nest 2 was a newly constructed nest which was being attended by both the wasp builder and the bee usurper.

The wasp cells utilized by the bee had been widened by the latter prior to the construction of its petal-cells. The petals utilized were those of a purple flowered *Cyanella* sp.(Amaryllidaceae) which was growing in the vicinity. After a petal-cell had been sealed with pieces of petal the excavated cell had been sealed with compacted soil.

Pollen from the provision, a mixture of pollen and nectar, was examined and found to be a mixture derived from three or more plant species. Pollen from *Cyanella* was examined but did not match any of the pollen derived from the bee's cells. Pollen is therefore being collected from different plants from that from which nesting materials are taken.

*Male behaviour*

Males of *M. familiaris* were observed and collected on flowers of *Aspalathus* spp., however, no interactions between males and females were observed. Males were not seen at nests and as *M. familiaris* has not yet been observed at water it is not known whether the males encounter the females when they are collecting water.

## DISCUSSION

As nothing was previously known of the nesting of any member of the genus *Masarina* it seems to be of interest to compare what is now known of the nesting of *M. familiaris* with what is known for other masarids.

The selection of a vertically presented soil surface is behaviourally distinct from the selection of a horizontally presented soil surface (Gess, 1981). The choice by *M. familiaris* of vertical banks for nesting thus distinguishes it behaviourally from the other masarid species known to nest in soil, 15 *Ceramius* spp. (Gess and Gess, 1980, 1986 and 1988), *Jugurtia confusa* Richards (Gess and Gess, 1980), *Quartinioides* sp. (Gess and Gess, 1985 unpublished field notes) and *Paragia tricolor* Smith (Houston, 1984).

The construction of an entrance turret is common to all masarid species recorded nesting in non-friable soil and using water in nest excavation. The only nester in soil not known to construct a turret is *Quartinioides* sp. which nests in friable soil.

The burrow plan of *M. familiaris* is unusual in that access to each cell is from a separate shaft, several shafts each ending in a cell being excavated in turn directly from the nest entrance. The burrow plan of *Ceramius* spp., *Jugurtia confusa* and *Paragia tricolor* is a main shaft with the cells terminating secondary shafts leading from it. Further, the excavated cell of *M. familiaris* differs in shape from those of the other soil nesting species investigated in that the sides are parallel and the diameter is equal to that of the shaft except for a narrow neck and a slight narrowing at the inner end which is truncate. The cell shape of the other species is somewhat ovoid with the diameter over most of the length exceeding that of the shaft and the end wall is rounded.

The egg of all the ground nesting masarids investigated has been recorded as being laid loose in the cell (Gess and Gess, 1980 and 1986, and Houston, 1984) whereas the egg of the aerial nesting *Pseudomasaris edwardsi* (Cresson) (Torchio, 1970) and *Gayella eumenoides* Spin. (Claude-Joseph, 1930 as quoted in Richards, 1962) is attached to the cell wall. It is therefore of interest that the egg of *M. familiaris* nesting in vertical banks, like that of the aerial nesters, is attached to the cell wall.

The provision of *M. familiaris* is very wet and sticky, clearly having a very high nectar content. This seems to be unusual for masarids and, as the cell walls have no obvious waterproofing, surprising. The more usual provision for masarids seems to be a rather dry or tacky loaf with a low nectar content such as has been described for *Ceramius* spp. (Gess and Gess, 1980 and 1986), *Jugurtia confusa* (Gess and Gess, 1980), *Paragia tricolor* (Houston, 1984) and *Pseudomasaris edwardsi* (Torchio, 1970). The only record of another masarid using wet provision seems to be that for *Gayella eumenoides* (Claude-Joseph, 1930 as quoted in Richards, 1962).

Clearly it is premature to draw any conclusions from these comparative comments.

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